conditions that the very existence of railways there depends upon the handling of enormously concentrated traffic with safety, certainty, and rapidity; and the results of these labors are probably not far from a perfect solution of the problem, and deserve our most careful study.

(*To be continued.*)

FIFTEENTH ANNUAL CONVENTION OF THE AMERICAN SOCIETY OF CIVIL ENGINEERS.[1] — II.

On Thursday the convention again assembled at St. Paul, at 11 A.M., and listened to a paper by J. P. Frizzell of St. Louis, upon the water-power at St. Anthony's Falls. The height of fall, watershed, rainfall, and horse-power utilized were given. He criticised the means taken for preserving the falls, the building of storage-dams at the head waters of the Mississippi, and the method of using the water at Minneapolis. He condemned the waste of power occasioned by a gross disregard of the laws of hydraulics, and pointed out the remedy. He stated that three things should be done, — the U. S. government must be induced to withdraw wholly, leaving the work of preservation of the falls to the owners of water-power; the two companies controlling the power must be united under one management; the natural width of channels at the falls must be restored.

Capt. O. E. Michaelis, U.S.A., followed with a short paper on metrological investigations, which he said were brought about by the attempt to determine how much a certain bullet was 'out of true.' He constructed and exhibited an instrument closely allied to the spherometer, to which he gave the name of 'tripod caliper.' He read results of measurements with this instrument, and applied it further to testing the accuracy of one turn of a screw-thread.

Mr. D. J. Whittemore, chief engineer of the Chicago, Milwaukee, and St. Paul railway, read a brief paper on the use of the Nasmyth steam-hammer for driving piles, and gave instances of the hindrance which a very slight 'brooming' of the pile-head offered to the effective action of the hammer. He also submitted a section from the top of a green Norway pine pile, where the friction of the fibres, under the rapid blows of the hammer, had generated sufficient heat to burn the heart of the head of the pile quite across.

Papers by Benjamin Reece, of Toledo, O., upon railway-track repairs, and by J. W. Putnam, upon cause of decay in timber, were read by title, and ordered printed in the proceedings.

[1] Concluded from No. 24.

In another room, before the persons most directly interested, a paper was read by F. P. Stearns of Boston, upon the current meter, giving a theory for the maximum velocity of water, flowing in an open channel, being found below the surface.

The society then held a business-meeting, in which a committee for nominating officers of the society was elected. Committees on uniform tests of cement and on the preservation of timber were granted further time. The committee appointed to procure aid from Congress to carry on the tests of iron and steel reported progress, and was continued.

The special committee on standard time made a report through Dr. Eggleston to the effect that they had obtained a general expression of opinion from men prominent as engineers, railway managers and operators, and others in all parts of the United States and Canada, and found that exceptional unanimity prevailed with respect to the fundamental principle which should govern in the adoption of a system of standard time for the whole country. The benefits of a change from the present lack of system were illustrated, and it was claimed that the time had arrived for action in the matter. The report was accepted, and the committee continued.

The convention at St. Paul then adjourned. The U. S. engineer officers on duty in this vicinity had an exhibit, in another room, of plans showing the various works of improvement under their charge.

On Friday, June 22, the convention met in Minneapolis. The party was carried from Hotel Lafayette across Lake Minnetonka by steamer, and thence by a narrow-gauge railway, in open cars, to the city. The meeting took place in the opera-house. A welcome was given by ex-Mayor Rand in behalf of the city; a reply and the annual address, in the absence of President Charles Paine, was read by Director William Metcalf, who took for his subject 'Engineering improvements in the Mississippi valley.'

Mr. William P. Shinn then read a paper upon the subject, 'How can railways be made more efficient in the transportation of freight?' which is a sequel to his paper of similar title read at the annual meeting in 1882, and aims to sum up the discussion, and more particularly to reply to the criticisms of Mr. O. Chanute thereon. He claims that facts and figures, which he adduces, prove that the present mileage basis for the adjustment of car accounts between different railroad companies is unjust to the companies furnishing the cars; that it is

costly and discouraging to prompt shippers; that it leads to slow movement of loaded cars and to non-movement of empty cars; that it is not practised in other countries, nor does any like practice obtain in any other business in this country. The *per-diem* basis, on the contrary, is perfectly practicable, as proved by two years' trial on the Union Pacific, and Chicago, Burlington, and Quincy railroads, and its use in a modified form in two European countries.

At noon the convention adjourned. The rest of the day, and Saturday, were given up to the very pleasant excursions and entertainments furnished by the people of the vicinity.

If one-half as much is done to render the coming meeting of the American association pleasant, those who attend will find themselves well entertained.

SOME GEYSER COMPARISONS.

HAYDEN'S twelfth annual report, published by the U. S. interior department, has been in the printer's hands for some time, and will doubtless be shortly issued from the government printing-office. Part ii. of this report relates to the Yellowstone national park, and in it the hot-springs are fully described, and the geology and topography of the park treated of in detail.

It is proposed here to point out briefly some of the differences in relation to geysers between the results of the work in the park and those reached by Bunsen in his study of the Iceland field. It is not necessary to present Bunsen's conclusions in detail, nor to describe his theory, with which doubtless the majority of the readers of SCIENCE are familiar.

Bunsen's conclusions, as presented here, are mainly the same as stated by LeConte in his Elements of geology, although not considered in the same order.

1. Bunsen found in Iceland two kinds of springs, viz., *acid springs* and *alkaline carbonate springs;* and he says that only *alkaline carbonate springs* become siliceous, and that only silicated springs form geysers.

2. The silica in solution does not deposit on cooling, but only by drying.

Our observations in the Yellowstone national park in the main verify this last conclusion, and it is inserted, because LeConte takes exception to it as follows: "This, however, is not true; for the Yellowstone geyser-waters, which[1] deposit abundantly by *cooling*, evidently because they contain much more silica than those of Iceland."

[1] This is evidently a grammatical error.

The following table gives the results of the observations in the park as far as they have been made in regard to the points just enumerated.

Name.	Character of spring.	Grains of silica to imperial gallon.	Reaction of water.	Condition of water after three years, when bottles were opened.
Jug . .	Quiet spr'g,	14.56	Alkaline,	Perfectly clear, no deposit.
Echinus .	Geyser . .	10.60	Acid . .	Perfectly clear, no deposit.
Pearl . .	Geyser . .	7.84	Alkaline,	Clear, with small deposit of gelatinous silica.
Opal . .	Quiet spr'g,	53.76	Alkaline,	Opaline as when bottled, no deposit in bottle.

Here, then, we have an alkaline spring and an acid spring, both of which are geysers. We see, also, that the mere fact of cooling has little to do with the throwing down of the silica, nor does the precipitation appear to be due to the amount of silica held in the water. Ordinarily the formation of siliceous sinter or geyserite must be explained by the evaporation or drying of the water as it flows from the springs, or falls from the geysers.

The chimney-like form is very noticeable in the craters of the Yellowstone geysers; and LeConte attributes it to the greater abundance of silica in solution in the waters of the Yellowstone geysers.[1]

As a fact, however, the analyses already made of geyser-waters from the park show usually a smaller percentage of silica than do those of Iceland. Opal spring (see table above) is an exception, and it is a spring without the least appearance of a crater or chimney. The real explanation is probably in the greater age of our geyser region.

3. Bunsen's conclusions as to temperature are as follows: —

a. The temperature increases with the depth of the tube.

b. At no point in the tube does the water have the temperature of ebullition which it should have under the pressure to which it is subjected.

c. The temperature depends on the time that has elapsed since the last eruption; and, as a great eruption approaches, the nearer it comes to the boiling-point.

d. At a depth of forty-five feet in the Great geyser, the difference between the observed temperature and the calculated boiling-point of the water for that depth and pressure was the least.

[1] Elements of geology, p. 104.